PART I - ADMINISTRATIVE

Section 1. General administrative information

Title of project

Umatilla River Basin Natural Production Monitoring And Evaluation

BPA project number: 9000501
Contract renewal date (mm/yyyy): 10/1999 ☐ **Multiple actions?**

Business name of agency, institution or organization requesting funding
Confederated Tribes of the Umatilla Indian Reservation

Business acronym (if appropriate) CTUIR

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NPPC Program Measure Number(s) which this project addresses
4.2A, 4.3C.1, 7.1A.2, 7.1C.3, 7.1C.4 and 7.1D.2

FWS/NMFS Biological Opinion Number(s) which this project addresses
N/A

Other planning document references
Wy-Kan-Ush-Mi Wa-Kish-Wit, Volume I, 5b-13 (CRITFC 1995)
Wy-Kan-Ush-Mi Wa-Kish-Wit, Volume II, pages 42-45, and 52-54 (CRITFC 1995)
Umatilla Hatchery Master Plan, pages 60-87 (CTUIR 1989)
Northeast Oregon Hatchery Project, Umatilla Hatchery Supplementation
Master Plan, pages 19-21 (CTUIR 1998)
Umatilla Basin recommened salmon and steelhead habitat (hatchery and passage)
improvement measures (CTUIR 1984)
A Comprehensive Plan for Rehabilitation of Anadromous Fish Stocks in
the Umatilla River Basin (CTUIR 1986)
Umatilla Basin Annual Operation Plan, Section VIII (ODFW and CTUIR 1998)

Short description
Monitor and evaluate natural spawning, rearing, migration, survival, life histories, age and growth characteristics, and genetic characteristics of adult salmon and steelhead and their natural progeny in the Umatilla River Basins.

Target species
Spring Chinook Salmon, Fall Chinook Salmon, Coho Salmon, Summer Steelhead, Bull Trout.

Section 2. Sorting and evaluation

Subbasin
Umatilla

Evaluation Process Sort

CBFWA caucus	Special evaluation process	ISRP project type
Mark one or more caucus	If your project fits either of these processes, mark one or both	Mark one or more categories
☒ Anadromous fish ☐ Resident fish ☐ Wildlife	☐ Multi-year (milestone-based evaluation) ☐ Watershed project evaluation	☐ Watershed councils/model watersheds ☐ Information dissemination ☐ Operation & maintenance ☐ New construction ☒ Research & monitoring ☐ Implementation & management ☐ Wildlife habitat acquisitions

Section 3. Relationships to other Bonneville projects

Umbrella / sub-proposal relationships. List umbrella project first.

Project #	Project title/description
20516	Umatilla Production M&E
9000501	Umatilla Natural Production M & E (subject sub-proposal, this document)
9000500	Umatilla Hatchery M&E (sub-proposal submitted separately)
8902401	Evaluation of Juvenile Salmonid Outmigration and Survival (sub-proposal submitted separately)

Other dependent or critically-related projects

Project #	Project title/description	Nature of relationship
8805302	Design and Construct Umatilla Hatchery, Supplement	Our project will measure the success of project No. 8805302 in terms of increased natural production
8373600	Umatilla Passage Facility Operations and Maintenance.	Our project measures the success of project No. 8373600 in terms of increased natural production
8902700	Power Repay Operations and Maintenance for USBR CRP Project	Our project measures the success of project No. 8902700 in terms of increased natural production
8343500	Umatilla Hatchery Satellite Operation and Maintenance	Our project measures the success of project No. 8343500 in terms of increased natural production
8802200	Umatilla Fish Passage Operations	Our project measures the success of project No. 8802200 in terms of increased natural production
8710001	Umatilla Fish Habitat Enhancement	Our project measures the success of project No. 8710001 in terms of increased natural production

Section 4. Objectives, tasks and schedules

Past accomplishments

Year	Accomplishment	Met objectives
1991-1998	***Spawning Surveys*** Annual spawning surveys document the location and timing of spawning for each species and stock. Annually, we estimated prespawning mortality, total number of redds, the ratio of redds/adult available to spawn and total egg deposition.	☒
1993-1998	***Habitat surveys*** Habitat surveys were coordinated and conducted by CTUIR, USFS and ODFW. CTUIR completed intensive habitat assessments on 138.5 miles of stream in the basin (1993-1998). This data provided the basis for estimating basin-wide salmonid abundance and production potential estimates. In addition, the Total Maximum Daily Load program and temperature modelers have been using this habitat data to examine pollution abatement options in the basin.	☒
1994-1996	***Radio telemetry*** This project completed a three-year evaluation of the adult passage facilities using radio telemetry techniques. We documented the successful passage of salmon and steelhead over all irrigation diversions in the Umatilla River. We observed adult passage problems only at Only Feed Canal Dam after gravel deposits blocked or impeded access to the fish ladder	☒
1992	***Genetic monitoring*** We collected samples for the genetic studies conducted by Currens and Schreck (1993, 1995). In 1999 we will collect additional samples for a follow up genetic evaluation study contracted with CRITFC for analyses and reporting in FY 2000.	☒
1993-1998	***Trapping*** We operated traps from 1993 to the present. We placed traps in tributaries, the upper mainstem Umatilla and in the mid-mainstem Umatilla River. Trap data has provided considerable age, growth and life history data. Estimating smolt production was confounded by floods, debris and trap damage. The outmigration of juvenile salmonids is highly variable. It is impossible to estimate the number of salmonids migrating past the trap when conditions prevent trapping. Unfortunately, river conditions frequently prevent trapping when smolt outmigration may be highest and most variable. These constraints prevented us from providing reasonable estimates of smolt abundance and smolt to adult survival rates for naturally produced salmon and steelhead. However, now that PIT tag interrogation systems are completed in the lower Columbia River dams, we can use PIT tags to estimate smolt migration timing, minimum survival and smolt to adult survival. Smolt to adult survival will depend on the detection of PIT tags in adults passing through the lower Columbia River dams and TMD. Detection of PIT tags in adults is still a developing technology and may not be immediately available.	☒
1993-1998	***Salmonid density and abundance estimates*** This project examines salmonid populations to determine their rearing success and production potential (1993-1998). We have observed natural juvenile salmon and steelhead in quality rearing habitat with densities often ranging from 50 to 200 fish/100 m^2 and occasionally as high as 400 fish/100 m^2 (Contor et al. 1994, 1995, 1996, 1997 and 1998). By combining salmonid density data with habitat assessment data, we estimate that natural salmonid production could triple with moderate improvements in stream habitat quality	☒

	(primarily water temperature, sediment and flows). Extensive improvements in stream habitat could yield additional production but would require the removal of passage barriers on some tributaries and extensive habitat improvements in the more degraded stream reaches.	
1994-1998	***Salmonid index*** We have established permanent index sites to monitor annual reproduction and rearing success of natural salmonids (1994-1998). Each year we estimate densities of salmon and steelhead at fixed sites throughout the basin. Salmonid abundance and densities have fluctuated with environmental conditions. We found steelhead rearing densities were higher and more stable from year to year than chinook salmon. Chinook salmon abundance has fluctuated significantly and is clearly related to the number of available spawners and the occurrence of high flows that can scour salmon redds.	☒
1993-1994	***Residualization*** We have observed few residual hatchery reared Umatilla steelhead during extensive sampling from 1993 through 1998. We estimate that by August less than 4,000 residual steelhead remain in the Umatilla River above Pendleton. Most residual hatchery steelhead have been observed in Boston Canyon Creek (a small stream near the Bonifer Pond Acclimation Facility).	☒
1993-1998	***Life Histories*** We have developed detailed knowledge of juvenile salmonid life histories in the Umatilla Basin by combining data from traps, electrofishing data (all four seasons) and from salmonid age and growth data (Contor et al. 1995, 1996, 1997 and 1998). For each species and each section of the basin we identified the primary risks to successful natural production. Risks include scouring of redds, high summer temperatures and excessive sedimentation.	☒
1993-1994	***Natural salmonid production estimates*** Natural production of salmonids has fluctuated annually with the availability of adults for spawning and environmental conditions such as floods and drought. Our estimates are based on habitat surveys, electrofishing efforts, spawning ground surveys, and water temperature data. We estimate that of the 770 miles of river and streams in the Umatilla Basin 233 of those miles are suitable for the natural production of approximately 600,000 to 900,000 steelhead and rainbow trout (ages 0+ to 4+). Currently, however only about 65 stream miles are utilized by spring chinook salmon for the spawning and rearing of 50,000 to 100,000 age 0+ and 1+ parr (Contor et al. 1998). Fall chinook and coho salmon have more than 50 miles of mainstem spawning habitat and are limited by availability of adults for spawning, sedimentation, redd scour and high water temperatures during June, July and August. Our companion project conducted by ODFW (Project No. 8902401) in the lower basin estimated that natural production of juvenile fall chinook salmon has been as high as 250,000 in 1998 (Sue Knapp, ODFW, personal communication). Natural production estimates for juvenile coho have been inconclusive because few adults have returned during 5 of the last 6 years and unmarked hatchery coho are often difficult to distinguish from natural coho.	☒
1993-1998	***Harvest monitoring*** CTUIR monitors the tribal harvest of summer steelhead and salmon. Tribal fisherman harvested from 25 to 39 steelhead annually from 1993 to 1998. Tribal spring chinook salmon fisheries have occurred during the summers of 1993, 1996 and 1997 with 176, 167 and 183 spring chinook harvested	☒

	respectively (Contor et al. 1998).	
1993-1998	***Temperature monitoring*** This project monitors water temperatures throughout the Umatilla River Basin in coordination with other CTUIR projects, ODFW, USFS and BOR. Water temperature data has been useful in estimating the suitability of stream reaches for salmonid production and in understanding current salmonid life histories and distributions in the basin. We provide water temperature data to DEQ and the TMDL program for thermal pollution assessments and water temperature modeling.	☒
1993-1998	***Bull trout information*** Workers record all pertinent data from any bull trout observed or collected during field activities (surveys, electrofishing, trapping, etc.). We share our bull trout data with any interested group or individual. In fact, a significant portion of the Umatilla River bull trout data reported in the ODFW's *Status of Oregon's Bull Trout* (Buchanan et al. 1997), was collected and reported to ODFW by our project personnel (CTUIR 1994, Contor et al. 1995, 1996 and 1997).	☒

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Monitor spawning activities of hatchery and natural spring and fall chinook and coho salmon, and summer steelhead in the Umatilla River Basin.	a	Document the number and locations of redds and examine carcasses in index areas and in other areas throughout the basin as conditions allow.
		b	Estimate survival to spawning and total egg deposition by species and reach.
		c	Collect and record length, sex, pre/post spawn mortality data, coded wire tags, marks, fin clips, kidney samples and scales from the appropriately marked carcasses examined on the spawning grounds.
		d	Bag, label, freeze and deliver snouts and kidney samples to the appropriate research laboratories for analysis.
		e	Digitize and summarize data, report findings, and discuss management implications
2	Estimate timing and survival of juvenile salmon and steelhead migrating from the headwaters of the Umatilla River to the Lower Columbia (John Day and Bonneville Dam PIT tag interrogation sites).	a	PIT tag natural juvenile chinook and summer steelhead collected in the headwaters of the Umatilla River Basin with rotary screw traps, electrofishing and other methods
		b	Develop and submit tagging, mortality and release files to PTAGIS
		c	Extract and examine PIT tag detections from PTAGIS detection files
		d	Estimate timing and minimum in-river survival from PIT tag detections at down-river sites
		e	Estimate smolt to adult survival from detections of PIT tagged adults returning

			in future years at mainstem dams and at TMD.
		f	Report findings and discuss management implications.
3	Estimate juvenile salmonid abundance and rearing densities in index sites and selected stream reaches in the Umatilla River Basin.	a	Electrofish established index sites. Isolate the site with block-nets and use depletion methods to estimate salmonid densities.
		b	Electrofish selected stream reaches using block-nets and depletion methods to estimate salmonid densities and abundance in priority areas as defined by the Management Oversight Committee.
		c	Digitize and summarize capture data, estimate densities and abundance, examine trends, report findings and discuss management implications.
4	Estimate tribal harvest of adult salmon and steelhead returning to the Umatilla River Basin (in cooperation with BIA).	a	Design and implement a roving creel survey and phone survey depending on season and location of fisheries as determined by tribal authorities.
		b	Digitize and summarize data, estimate harvest and report findings.
5	Monitor stream temperatures in the Umatilla River Basin in cooperation with other monitoring agencies	a	Meet with other agencies to coordinate temperature-monitoring activities.
		b	Deploy 6 Ryan RTM2000 and 15 Vemco Minilog thermographs in April of 2000. Check status and function of thermographs in July
		c	Retrieve thermographs in November. Download, summarize and graph data. Examine trends, report findings and discuss management implications.
6	Determine age, growth and life history characteristcs of bull trout, salmon and steelhead in the Umatilla River Basin.	a	Take scales from juvenile and adult salmon and steelhead during trapping, electrofishing and spawning surveys.
		b	Mount and press adult scale samples. Place juvenile scales directly between labeled acetate sheets at the time of sampling.
		c	Determine the proportion of unmarked adult salmon that are of hatchery and natural origin based on circuli counts from the scale focus to the first annuli.
		d	Determine the years of freshwater and saltwater rearing of adult natural steelhead and salmon.
		e	Digitize and summarize data, report findings and discuss management implications.
7	Determine and compare genetic characteristics of Umatilla River steelhead with previous genetic data.	a	Deliver genetic samples collected in FY1999 to one or several laboratories for analysis. CRITFC geneticists will analyze the data, report findings and

			discuss management implications (FY2000).
		b	Attach geneticists' report to annual report.
8	Improve and update the monitoring and evaluation strategies for the Umatilla River Basin. Coordinate with the Management Oversight Committee to ensure an effective M&E program.	a	Meet with Management Oversight Committee to determine monitoring needs.
		b	Modify and develop the monitoring and evaluation program to meet identified needs.
9	Examine the movements of 30 adult fall chinook salmon after transport to the Umatilla River from Priest Rapids Hatchery and/or Ringold Springs Hatchery.	a	Radio-tag and release 30 adult fall chinook salmon into the Umatilla River in early to mid October.
		b	Monitor the movement of tagged adult fall chinook with fixed site and mobile receivers.
		C	Summarize results, report findings and discuss management implications.

Objective schedules and costs

Obj #	Start date mm/yyyy	End date mm/yyyy	Measurable biological objective(s)	Milestone	FY2000 Cost %
1	11/1985	12/2007			25.00%
2	03/1998	12/2007			15.00%
3	06/1993	12/2007			25.00%
4	4/1993	12/2007			4.00%
5	05/1993	12/2007			4.00%
6	04/1993	12/2007			4.00%
7	03/1993	12/2009			15.00%
8	3/1999	12/2007			4.00%
9	10/1999	01/2000			4.00%
				Total	96.00%

Schedule constraints

This is a long-term monitoring project. We have crews working in the field every week of the year. Scheduling changes would not affect this project unless it removed personnel from the field.

Completion date

The completion date is unknown. This is a long term monitoring project that is reviewed annually by the Management Oversight Committee. We expect this project to be reduced to a streamlined monitoirng program at some time in the future, but project activities are subject to the information needs of the Management Oversight Committee.

Section 5. Budget

FY99 project budget (BPA obligated): $610,400

FY2000 budget by line item

Item	Note	% of total	FY2000
Personnel	6.25 FTE	%44	270,165
Fringe benefits	29%	%13	78,348
Supplies, materials, non-expendable property		%3	19,700
Operations & maintenance		%0	0
Capital acquisitions or improvements (e.g. land, buildings, major equip.)		%0	0
NEPA costs		%0	0
Construction-related support		%0	0
PIT tags	# of tags: 3000	%1	8,700
Travel		%5	29,200
Indirect costs	34%	%23	138,078
Subcontractor	CRITFC Genetics Work	%11	65,000
Other		%0	0
TOTAL BPA FY2000 BUDGET REQUEST			$609,191

Cost sharing

Organization	Item or service provided	% total project cost (incl. BPA)	Amount ($)
BIA	Harvest Monitor	4.6%	$30,000
CTUIR	Summer Youth, Bio-Aids	2.2%	$14,400
Total project cost (including BPA portion)			$653,591.00

Outyear costs

	FY2001	FY02	FY03	FY04
Total budget	$586,000	$625,000	$660,000	$695,000

Section 6. References

Watershed?	Reference
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PART II - NARRATIVE

Section 7. Abstract

Our project goal is to provide information to managers and researchers working to restore anadromous salmonids to the Umatilla River Basin. This is the only project that monitors the restoration of naturally producing salmon and steelhead in the basin. The project objectives are to measure, estimate and report salmonid spawning success, rearing densities and abundance, habitat quality and quantity, production capacity of the basin, life history characteristics, and migration timing and success. This project also monitors tribal harvest (roving creel and telephone surveys) and water temperatures (Ryan and Vemco thermographs) in coordination with ODFW, USFS and other CTUIR projects.

Researchers and managers from throughout the basin examine and modify the project during monthly and annual coordination meetings. We strive to provide the best information for adaptive management of local salmon and steelhead. The information generated by this project also has utility for salmonid restoration efforts throughout the Columbia River Basin.

While certain monitoring activities are conducted each year, others objectives are already completed or were deferred to future years through prioritization, need, and limitations in personnel and funding. Adult passage facility evaluations, physical habitat surveys and genetic monitoring are examples of this. Currens and Schreck (1993, 1995) developed a genetic baseline for endemic steelhead in the Umatilla Basin from samples collected in 1992 and 1994 (allozyme and mtDNA). We will collect genetic samples from steelhead again in FY1999 and coordinate the processing, analysis and reporting with established laboratories and genetic scientists in FY2000. Geneticists will use both electrophoresis and DNA techniques to begin examining the hypothesis that current artificial propagation of endemic steelhead does not alter the population’s genetic characteristics. The Management Oversight Committee will likely request genetic monitoring again in 2009.

We communicate findings to researchers and managers through formal reports, monthly oversight committee meetings, annual basin operation meetings, and formal presentations at various conferences and forums.

Section 8. Project description

a. Technical and/or scientific background

Project Background

This project is under a “Proposal Umbrella” with two ODFW research projects that also monitor and evaluate the success of the Umatilla Fisheries Restoration Plan. Our project deals with the natural production component of the plan and the ODFW projects evaluate hatchery operations (project No. 9000500, Umatilla Hatchery M & E) and smolt outmigration (project No. 8902401, Evaluation of Juvenile Salmonid Outmigration and Survival in the Lower Umatilla River). All together, these three projects comprehensively monitor and evaluate natural and hatchery salmonid production in the Umatilla River Basin.

The need for monitoring the natural production of salmonids in the Umatilla River Basin developed with the efforts to restore natural populations of spring and fall chinook salmon, (*Oncorhynchus tshawytsha)* coho salmon and (*O. kisutch*) and enhance summer steelhead (*O. mykiss*). The need for restoration began with agricultural development in the early 1900's that extirpated salmon and reduced steelhead runs (BOR 1988). The most notable development was the construction and operation of Three-Mile Falls Dam (TMD) and other irrigation projects that dewatered the Umatilla River during salmon migrations. The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and the Oregon Department of Fish and Wildlife (ODFW) developed the Umatilla Hatchery Master Plan to restore the historical fisheries in the basin (CTUIR 1984 and ODFW 1986). The plan was completed in 1990 and included the following objectives:

1) Establish hatchery and natural runs of chinook and coho salmon.
2) Enhance existing summer steelhead populations through a hatchery program.
3) Provide sustainable tribal and non-tribal harvest of salmon and steelhead.
4) Maintain the genetic characteristics of salmonids in the Umatilla River Basin.
5) Produce almost 48,000 adult returns to Three-Mile Falls Dam.

This monitoring project began in 1992 and was expanded to the Walla Walla River Basin in FY1998 and FY1999. However, the Walla Walla monitoring effort will be a separate project in FY2000. This project is one of more than ten subprojects in the Umatilla Fisheries Restoration Program. Our team is the only project evaluating the natural production of salmon and steelhead in the basin. We evaluate how natural production goals for salmon and summer steelhead are being achieved. We provide specific information regarding natural spawning, rearing, migration and harvest to aid adaptive management.

We conduct core-monitoring activities each year as well as two and three-year projects that address special needs for adaptive management. Examples of these projects include adult passage evaluations (Kissner 1992, Volkman 1993, 1994, Contor et al. 1995, 1996 and 1997), genetic monitoring (Currens and Schreck 1993, 1995) and habitat assessment surveys (CTUIR 1994, Contor et al. 1995, 1996 and 1997). Our project cooperates directly with other project such as ODFW's evaluation of juvenile salmonid outmigration and survival in the lower Umatilla River (Project No. 89-024-041). We also collect kidney samples and coded wire tags from spawning carcasses for ODFW research projects. This project is an integral part of Umatilla Basin Restoration projects outlined in section 8 (c) below.

Our project has accomplished a number of objectives and provided substantial information regarding the restoration and natural production of salmon and steelhead in the Umatilla River Basin since 1992. As outlined by Lichatowich's original monitoring and evaluation plan (Lichatowich 1992), we will trim this project down to core-monitoring activities after completing several more intensive objectives. These objectives include; refine the estimate of juvenile salmonid abundance and production in the basin; determine smolt to adult survival rates, and evaluate steelhead supplementation efforts. We have summarized our significant work history in section 8 (d) below.

Location Description

The Umatilla River Basin in northeast Oregon has a drainage area of 2,290 square miles. The Umatilla River originates on the west slope of the Blue Mountains, east of Pendleton, and flows 115 miles in a northwesterly direction to the Columbia River at RM 289. The lower river, west of Pendleton, has cut a low valley into multiple layers of middle Miocene basalt flows. East of Pendleton, foothills and the Blue Mountains dominate the region. The rivers and streams have cut steep sided canyons into the layers of basalt that form the Blue Mountains. The combination of steep canyon walls and impervious bedrock lends to poor ground water recharge (NPPC 1990). U.S. Geological Survey (USGS) river-flow data from 1904 through 1997 show stream hydrographs with large variations between high and low flows.

Review of Supplementation

The primary goal of supplementation as applied to steelhead in the Umatilla Restoration Project is to increase natural production and produce surplus adults for harvest (CTUIR 1984, ODFW 1986). The effects of releasing hatchery reared salmonids with wild and natural salmonid populations have been explored from a variety of perspectives. Strategies to examine this topic have ranged from monitoring genetic heterozygosity and the persistence of unique alleles to evaluating the performance of hatchery and wild salmonids spawning naturally. Some researchers have discussed and provided compelling evidence indicating hatchery programs may decrease the production on natural salmonids. (Nickelson et al. 1986, Vincent 1987, Leider et al. 1990, Flemming and Gross 1991, Steward and Bjornn 1990). Others have advised using supplementation to restore and enhance natural populations (CTUIR 1994, ODFW 1986, Bowles and Leitzinger 1991, NPPC 1987 and 1990).

The effects of supplementation on the genetics of natural populations have been of primary concern in the fisheries literature (Reisenbichler and Phelps 1989, Meffe 1992, Steward and Bjornn 1990, Ferguson et al. 1991). Research in stock genetics has demonstrated that hatchery spawning practices can have a variety of effects on population genetics. Allendorf and Phelps (1980) found hatchery cutthroat trout (*O. clarki)* had lost genetic variation over time. Reisenbichler and Phelps (1989) found significant genetic differences between hatchery and wild steelhead in northwest Washington. They attributed these genetic differences to hatchery broodstock selection and spawning practices. Ferguson et al. (1991) found ancestral and descendant rainbow trout did not have significantly different allelic frequencies when modern breeding techniques were practices. Byrne et al (1992) modeled the genetics of steelhead supplementation strategies using an equally fit broodstock with different alleles. He demonstrated that often "supplementation of native stocks with hatchery fish causes replacement, not enhancement of native fish." Byrne (et al. 1992) and Meffe (1992) both emphasized that to enhance natural steelhead, carrying capacity of the rearing and migratory habitat must be restored and maintained.

The Umatilla hatchery program minimizes genetic risks by breeding endemic naturally produced steelhead with modern techniques (matrix spawning). Occasionally first generation hatchery adults are used for spawning during shortages (Rowan 1991, 1994, 1995). Managers are optimistic that artificially propagating wild steelhead with modern breeding techniques will not degrade endemic steelhead. Lichatowich (1992) recommended long-term monitoring of the performance and genetic characteristics of endemic Umatilla steelhead to fully evaluate the Umatilla supplementation strategy.

Supplementation is expected to increase the total number of steelhead rearing within the basin, migrating to the ocean and returning as adults. Researchers suggest that supplementation may have some unintended affects that may include reduced survival and growth of natural salmonids through predation, competition, disease transmission, and behavior modification. Predation by hatchery fish on wild fry has been documented. However, researchers report that hatchery steelhead smolts prey primarily on macroinvertebrates (Hillman and Mullan 1989, Steward and Bjornn 1990, Cannamela 1992). However, Horner (1978) found some hatchery steelhead became highly piscivorous with salmonids comprising 50% of their diets. Cannemela (1993) examined the stomachs of 6,700 hatchery steelhead smolts for predation on naturally produced chinook fry. Cannemela estimated that hatchery smolts prey on chinook fry at low rates (0.0014 fry/smolt).

Competition and displacement occurs when individuals compete for limited resources (Chapman 1966, Everest and Chapman 1972). We have found little evidence for increased competition with natural steelhead from hatchery juveniles in rearing areas of the Umatilla Basin. Hatchery releases generally occur during moderately high flows when space and food do not appear to be limiting. Furthermore, most hatchery salmonids start their downstream migration directly after release. During electrofishing surveys (CTUIR 1994, Contor et al. 1995, 1996, 1997) few residual hatchery were captured. Boston Canyon Creek, near the Bonifer Acclimation Facility was an exception. We estimated 1,100 hatchery steelhead residualized there in 1993. Natural steelhead over 75 mm were rarely found in that tributary and were apparently displaced by hatchery steelhead. Researchers report that most residuals remain near the point of release (Cannamela 1992, 1993, Hillman and Mullan 1989). Hatchery residuals in the Umatilla Basin exhibit the same behavior. We estimated that approximately 4,000 hatchery steelhead residualize each year in Boston Canyon Creek, Meacham Creek, Minthorn Springs Creek and in the mainstem of the Umatilla River (CTUIR 1994, Contor et al. 1995). That was a summer residualization rate of 2.7% and represents 0.6% of the total juvenile steelhead in the basin. Residualization rates in the Umatilla are similar to Viola and Schucks' (1991) findings in southeast Washington (9.9% in early summer to 0.8% in October).

Hillman and Mullan (1989) observed behavior alterations of natural chinook fry in the presence of hatchery reared chinook. Natural chinook fry not subject to the hatchery releases showed no change in behavior. However, natural chinook behavior did not change during hatchery steelhead releases. Vincent (1987) demonstrated dramatic increases of natural brown trout (*Salmo trutta*) and rainbow trout population once stocking hatchery rainbow trout ceases. Vincent reported that stocking increased the natural mortality rates of wild trout. Bachman (1984) observed frequent and long antagonistic encounters between wild hatchery reared trout. These encounters often resulted in the exhaustion of wild trout. Poor survival, excessive activity and energy expenditure for "unnecessary aggressive behavior" by hatchery trout was also reported by Mesa (1991). Petrosky and Bjornn (1988) found that stocking rainbow trout at lower densities did not change the abundance, survival and growth of wild rainbow and cutthroat trout.

The primary assumptions of steelhead supplementation in the Umatilla Basin include: 1, quality habitat is significantly underutilized; 2, flooding the system with hatchery spawners (of wild parents) will utilize vacant habitat for additional natural production, and 3, benefits to wild steelhead outweigh potential risks. After six years of intensive fieldwork, it appears that quality habitat in the basin is already fully utilized by resident or anadromous rainbow trout. Extensive habitat and biological surveys throughout the basin (CTUIR 1994, Contor et al. 1995, 1996, 1997) indicate that quality habitat is well utilized and juvenile salmonid densities ranged from 40 to 400 fish/100m^2. Our data suggests that during the early 1990s the lack of quality rearing habitat limited natural smolt abundance and not the number of adult spawners. The production of adult steelhead was limited by smolt production in the basin and smolt survival through the lower Umatilla and Columbia Rivers.

The effectiveness of hatchery steelhead to reproduce naturally has not been examined in detail in the Umatilla Basin. Chilcote (et al. 1986) and Campton (et al. 1991) concluded that hatchery steelhead reproduce at 28% and 15% of the rate of natural steelhead, respectively. Leider (et al. 1990) found that the progeny of hatchery steelhead did not survival as well as progeny form natural steelhead. The Umatilla steelhead program is different because natural, endemic, steelhead are used for brood. CTUIR spawning surveys from 1991 through 1998 have observed many hatchery steelhead spawning naturally. The ratio of redds observed to total steelhead counted at TMD has remained about the same from 1991 through 1998 while the percent of hatchery steelhead fish ranged from 19% in 1991 to 59% in 1996. This suggests that Umatilla hatchery steelhead spawn at similar rates as natural steelhead. While we did not formally examine the differences in the quality of redds made by hatchery and natural steelhead, there was no consistent and obvious difference in quality between redds made by natural or hatchery steelhead.

Tribal and State managers speculate that Umatilla hatchery steelhead reproduce at higher rates than Campton (et al. 1991) estimated. Managers suggest that the decrease in natural adult returns in the Umatilla Basin is based on regional trends and is not a result of supplementation. The decrease in Umatilla steelhead is not as severe as in other basins. However, the decrease does follow regional trends as demonstrated by declines of natural adult returns in the John Day Basin (un-supplemented) as well as declines of natural steelhead in the Walla Walla, Grande Ronde, and Imnaha Basins (supplemented, Chilcote 1997).

b. Rationale and significance to Regional Programs

This project is the measuring tool of natural production restoration efforts in the Umatilla River Basin as outlined in the NPPC Columbia River Basin Fish and Wildlife Program (section 3.1B, 1994). The Umatilla Basin fisheries restoration program is a direct result of planning and restoration efforts of CTUIR (1984), ODFW (1986), BPA (1994) and NPPC (1990). We provide detailed information regarding the natural spawning, rearing and migration success of spring chinook salmon, fall chinook salmon, coho salmon and summer steelhead. This project's fundamental purpose is to measure the success of the salmon and steelhead restoration efforts and provide information for adaptive management. Information we provide also has utility for restoration efforts throughout the Columbia River Basin.

c. Relationships to other projects

This project is in a "Proposal Umbrella" with the ODFW research project "Evaluation of Juvenile Salmonid Outmigration and Survival in the Lower Umatilla River" No 8902401, and the ODFW research project "Umatilla Hatchery Monitoring and Evaluation Project" No. 9000500. Their equipment detects our PIT tagged fish near the mouth of the Umatilla River. They are an essential part of natural production migration studies in the Umatilla River.

This project is an integral part of the Umatilla Basin Restoration Effort. It is the logical monitoring component to measure the natural production benefit from the projects outlined below.

Watershed Enhancement and Rehabilitation Projects

- Squaw Creek Watershed Project – Anadromous Portion, No. 9506000
- Umatilla River Basin Anadromous Fish Habitat Enhancement, No. 710001
- Umatilla Habitat Improvement / ODFW – Implementation / O&M. No. 8710002

Hatchery Construction and Operations Projects

- Umatilla Hatchery Satellite Facilities Operation and Maintenance, No. 8343500
- Umatilla Hatchery Satellite Facilities Planning, Siting, Design and Construction, No. 9101400
- Umatilla Hatchery Operations and Maintenance, No. 9803500

Adult Passage Facility Construction and Operation on the Umatilla River (several projects and multiple facilities)

Flow Augmentation to Increase Instream Flows in the Umatilla River (several projects and multiple facilities).

Umatilla Passage Operations Project, No. 8802200

We depend on Columbia Basin PIT Tag Information System, project No. 9008000, to coordinate and store PIT tagging, interrogation and detection data.

During 1998 and 1999 this project had joint objectives in the Walla Walla Basin. For FY 2000 some of our personnel will work part time on this project and part time in the Walla Walla Basin.

We forward all observations of bull trout to ODFW. Data includes bull trout rearing densities, distribution, abundance, age and growth, and the location and timing of spawning. We also provide the Pacific Lamprey Research and Restoration Project, No. 9506000 with any information we collect on juvenile and adult lamprey.

d. **Project history** (for ongoing projects)

This project began in 1992 and is in its seventh year. The project's work history is summarized by year with dates, project numbers, contract numbers, costs, project reports and documents. The work history is also summarized by objective.

Work History by Year

Year one: September 30, 1992 through September 29, 1993, BPA project no. 90-005-01, contract no. DE-B179- (92BP75349), projected cost $377,000 and actual cost $352,000.

Reports and documents: statement of work, annual report (CTUIR 1994) and quarterly reports.

Activities (1992-1993) included hiring personnel, began habitat surveys (after Moore et al. 1993), completed habitat survey training, installed and operated traps, initiated salmonid abundance monitoring, conducted extensive spawning surveys basin wide, initiated temperature monitoring, and collected samples for genetic baseline data (Currens and Schreck 1993). We observed high prespawning mortality of spring chinook salmon below river mile 78 because of high water temperatures.

Year two: September 30, 1993 through September 29, 1994, BPA project no. 90-005-01, contract no. DE-B179-(92BP75349), projected cost $495,000 and actual cost $427,000.

Reports and documents: BPA project review, statement of work, annual report (Contor et al 1995a) and quarterly reports.

Activities (1993-1994) included continuing habitat surveys, trapping, spawning surveys, salmonid abundance surveys and temperature monitoring. Quality habitat found to be less abundant that Master Plan estimated, and quality steelhead rearing habitat more fully utilized than Master Plan estimated.

Year three: September 30, 1994 through September 29, 1995, BPA project no. 90-005-01, contract no. DE-B179-(92BP75349), projected cost $615,000 and actual cost $605,000.

Reports and documents: BPA proposal, statement of work, annual report (Contor et al. 1996a) and quarterly reports.

Activities (1994-1995) included the addition of the adult passage project (radio telemetry). We continued habitat surveys, trapping, spawning surveys, salmonid abundance surveys, and temperature monitoring. Telemetry results suggested Feed Canal Dam delays adult migration (Contor et al 1996, 1997).

Year four: September 30, 1995 through September 29, 1996, BPA project No. 90-005-01, contract no. DE-B179-(92BP75349), projected cost $649,000 and actual cost $524,000.

Reports and documents: BPA proposal, statement of work, annual report (Contor et al. 1997) and quarterly reports.

Activities (1995-1996) included the completion of adult passage evaluations. Feed Canal Dam continued to delay migrating adult salmon and steelhead. We continued habitat surveys, trapping, spawning surveys, salmonid abundance surveys, and temperature monitoring. We freeze branded juvenile outmigrants (after Knight 1990) but obtained less than 20 recaptures. We recommended waiting for the installation of PIT tag detectors in the lower Columbia River dams before attempting additional smolt survival studies.

Year five: September 30, 1996 through September 29, 1997, BPA project no. 90-005-01, contract no. DE-B179-(92BP75349), projected costs $650,000 and actual cost $470,000.

Reports and documents: BPA proposal; statement of work; annual report (Contor et al. 1998), and quarterly reports.

Activities (1996-1997) included the completion of habitat surveys, the continuation of trapping, spawning surveys, salmonid abundance surveys and temperature monitoring. We marked juvenile salmonids with visible tags. No recaptures were observed at TMD. Tag retention was good on test groups. Again, we recommended using PIT tags for further smolt migration survival studies and to wait until the installation of PIT tag detection systems lower Columbia dams was completed.

Outyear plans for monitoring and evaluation changed drastically. Genetic monitoring was dropped from1998 work plan. Supplementation evaluations were dropped indefinitely. One biologist and two technicians transferred to other programs. We advertised, interviewed and selected personnel to fill research positions but they were not hired at the last minute in fear of future budget constraints. As a result of not hiring replacement personnel, annual costs of the project decreased dramatically and a large carryover occurred. As a result of fewer personnel, habitat data, temperature data and salmonid density data was not critically evaluated.

Year Six: October 1, 1997 through September 30, 1998, BPA project no. 90-005-01, contract no. DE-B179-(92BP75349), projected cost was $546,000 and actual cost was $436,000

Reports and documents: BPA Proposal, statement of work, annual report (Contor et al. 1999 in prep.) and quarterly reports.

Activities (1997-1998) included expanding the project to include the Walla Walla Basin and develop a Walla Walla monitoring plan. We continued trapping, spawning surveys, salmonid abundance surveys, and temperature monitoring. We began coordination of genetic monitoring for FY1999 and FY2000. Could not begin PIT tagging smolts in the Umatilla River Basin because a delay in a budget modification delayed the delivery of PIT tags until the end of the fiscal year.

Year Seven (Current Year): October 1, 1998 through September 30, 1999, BPA project no 90-005-01, contract no. DE-B179-(92BP75349) and projected cost is $609,799

Reports and documents: BPA Proposal, statement of work, annual report (Contor et al. 2000 in prep.) and quarterly reports.

Planned activities (1998-1999) include conducting M&E work in both the Umatilla and Walla Walla Basins (Umatilla and Walla Walla M&E projects will be separate projects in FY2000). For the

Walla Walla Basin we will continue to improve the monitoring plan, continue temperature monitoring, collect samples for genetic studies, and begin salmonid abundance and spawning surveys. In the Umatilla River Basin we will begin PIT tagging smolts and continue trapping, spawning surveys, harvest monitoring, salmonid abundance surveys and temperature monitoring.

Work History by Objective

Spawning Surveys

Annual spawning surveys (1991-1998) documented the location and timing of spawning for each species and stock. Annually, we estimated prespawning mortality, total number of redds, the ratio of redds/adult available to spawn and total egg deposition.

Trapping

We operated traps from 1993 to the present. We placed traps in tributaries, the upper mainstem Umatilla and in the mid-mainstem Umatilla River. Trap data has provided considerable age, growth and life history data. Estimating smolt production was confounded by floods, debris and trap damage. The outmigration of juvenile salmonids is highly variable. It is impossible to estimate the number of salmonids migrating past the trap when conditions prevent trapping. Unfortunately, river conditions frequently prevent trapping when smolt outmigration may be highest and most variable. These constraints prevented us from providing reasonable estimates of smolt abundance and smolt to adult survival rates for naturally produced salmon and steelhead. However, now that PIT tag interrogation systems are completed in the lower Columbia River dams, we can use PIT tags to estimate smolt migration timing, minimum survival and smolt to adult survival. Smolt to adult survival will depend on the detection of PIT tags in adults passing through the lower Columbia River dams and TMD. Detection of PIT tags in adults is still a developing technology and may not be immediately available.

Salmonid density and abundance estimates

This project examines salmonid populations to determine their natural rearing success and production potential (1993-1998). We have observed natural juvenile salmon and steelhead in quality rearing habitat with densities often ranging from 50 to 200 fish/100 m^2 and occasionally as high as 400 fish/100 m^2 (Contor et al. 1994, 1995, 1996, 1997 and 1998). By combining salmonid density data with habitat assessment data, we estimate that natural salmonid production could triple with moderate improvements in stream habitat quality (primarily water temperature, sediment and flows). Extensive improvements in stream habitat could yield additional production but would require the removal of passage barriers on some tributaries and extensive habitat improvements in the more degraded stream reaches.

Salmonid index

We have established permanent index sites to monitor annual reproductive and rearing success of natural salmonids (1994-1998). Each year we estimate densities of salmon and steelhead at fixed sites throughout the basin. Salmonid abundance and densities have fluctuated with environmental conditions. We found steelhead rearing densities were higher and more stable from year to year than chinook salmon. Chinook salmon abundance has fluctuated significantly and is clearly related to the number of available spawners and the occurrence of high flows that can scour salmon redds.

Harvest monitoring

CTUIR monitors the tribal harvest of summer steelhead and salmon. Tribal fisherman harvested from 25 to 39 steelhead from 1993 to 1998. Tribal spring chinook salmon fisheries have occurred during the summers of 1993, 1996 and 1997 with 176, 167 and 183 spring chinook harvested respectively (Contor et al. 1998).

Temperature monitoring

This project monitors water temperatures throughout the Umatilla River Basin in coordination with other CTUIR projects, ODFW, USFS and BOR. Water temperature data has been useful in estimating the suitability of stream reaches for salmonid production and in understanding current salmonid life histories and the distribution of salmonids in the basin. We provide water temperature data to DEQ and the TMDL program for thermal pollution assessments and water temperature modeling.

Life Histories

We have developed detailed knowledge of juvenile salmonid life histories in the Umatilla Basin by combining data from traps, electrofishing data (all four seasons) and from salmonid age and growth data (CTUIR 1994, Contor et al. 1995, 1996, 1997 and 1998). For each species and each section of the basin we identified the primary risks to successful natural production. Risks include scouring of redds, high summer temperatures and excessive sedimentation.

Genetic monitoring

We collected samples for the genetic studies conducted by Currens and Schreck (1993, 1995). In 1999 we will collect additional samples for a follow up genetic evaluation study contracted with CRITFC for analyses and reporting in FY 2000.

Habitat surveys

Habitat surveys were coordinated and conducted by CTUIR, USFS and ODFW. CTUIR completed intensive habitat assessments on 138.5 miles of stream in the basin (1993-1998). This data provided the basis for estimating basin-wide salmonid abundance and production potential estimates. In addition, the Total Maximum Daily Load program and temperature modelers have been using this habitat data to examine pollution abatement options in the basin.

Radio telemetry

This project completed a three-year evaluation of the adult passage facilities using radio telemetry techniques (1994-1996). We documented the successful passage of salmon and steelhead over all irrigation diversions in the Umatilla River. We observed adult passage problems only at Feed Canal Dam after gravel deposits blocked or impeded access to the fish ladder.

Residualization

We have observed few residual hatchery reared Umatilla steelhead during extensive sampling from 1993 through 1998. We estimate that by August less than 4,000 residual steelhead remain in the Umatilla River above Pendleton. Most residual hatchery steelhead were observed in Boston Canyon Creek (a small stream near the Bonifer Pond Acclimation Facility).

Natural salmonid production estimates

Natural production of salmonids has fluctuated annually with the availability of adults for spawning and environmental conditions such as floods and drought. Our estimates are based on habitat surveys, electrofishing efforts, spawning ground surveys, and water temperature data. We estimate that of the 770 miles of river and streams in the Umatilla Basin 233 of those miles are suitable for the natural production of approximately 600,000 to 900,000 steelhead and rainbow trout (ages 0+ to 4+). Currently, however only about 65 stream miles are utilized by spring chinook salmon for the spawning and rearing of 50,000 to 100,000 age 0+ and 1+ parr (Contor et al. 1998). Fall chinook and coho salmon have more than 50 miles of mainstem spawning habitat and are limited by availability of adults for spawning, sedimentation, redd scour and high water temperatures during June, July and August. Our companion project conducted by ODFW (Project No. 8902401) in the lower basin estimated that natural production of juvenile fall chinook salmon has been as high as 250,000 in 1998 (Sue Knapp, ODFW, personal communication). Natural production estimates for juvenile coho have been inconclusive because few adults have returned during 5 of the last 6 years and unmarked hatchery coho are often difficult to distinguish from natural coho.

Bull trout information

Workers record all pertinent data from any bull trout observed or collected during field activities (surveys, electrofishing, trapping, etc.). We share our bull trout data with any interested group or individual. In fact, a significant portion of the Umatilla River bull trout data reported in the ODFW's *Status of Oregon's Bull Trout* (Buchanan et al. 1997), was collected and reported to ODFW by our project personnel (CTUIR 1994 Contor et al. 1995, 1996, and 1997).

e. Proposal objectives

Proposal objectives are listed in section 4 above and with the methods and hypotheses in section 8 (f), immediately below.

f. Methods

Objective 1. Monitor spawning of hatchery and natural adult spring chinook, fall chinook and coho salmon, and summer steelhead in the Umatilla River Basin. This is a monitoring objective with an underlying hypothesis that adult spawning will increase as a direct result of restoration efforts

Task 1.1 Document the number and locations of redds and examine carcasses in index areas and other areas throughout the basin as conditions allow.

Task 1.2 Estimate survival to spawning and total egg deposition by species and reach.

Task 1.3 Collect and record length, sex, pre and post-spawn mortality data, coded wire tags, marks, fin clips, kidney samples and scales from the appropriate carcasses examined on the spawning grounds.

Task 1.4 Bag, label, freeze and deliver snouts and kidney samples to the appropriate research laboratories for analysis.

Task 1.5 Digitize and summarize data, report findings and discuss management implications.

Objective 1. Methods

We conduct spawning ground surveys to enumerate summer steelhead, spring and fall chinook and coho salmon redds and sample mortalities in various reaches of the Umatilla River Basin. We repeat surveys in areas with spawning or holding adults. Other areas are surveyed fewer times if few spawners are observed. Poor water conditions may also prevent surveys. We wear polarized glasses to assist observation. To minimize stress on prespawning salmonids, we do not probe debris jams or throw rocks into holding pools. Two surveyors walk three to four miles daily. They walk alone along the margins of the smaller tributaries or together on opposite banks of larger streams.

Redds are judged to be complete based on redd size and depth, location, and amount and size of rock moved. All redds are reviewed by our most experienced surveyors for consistency. Redds are marked with orange flagging labeled with the date, location, species and number of males and females observed on or near the redd. Crews also record information in data books. For each redd, surveyors record the stream name, location, date the redd was first observed, sex and number of fish observed on or near the redd, carcasses sampled in the areas, and habitat type.

Carcasses found during the survey are measured from the middle of the eye to the hypural plate (MEHP). Fork length is also recorded if severe caudal fin erosion has not occurred. We describe obvious injuries and attempt to determine the cause of death in prespawning salmonids. We cut open carcasses to determine egg retention of the females and spawning success of the males. Prespawning mortality is defined as death of a fish before spawning. Females with egg retention estimated near 100% and males with full gonads are classified as prespawning mortalities. Tails of sampled fish are removed at the caudal peduncle to prevent re-sampling. We collect snouts from salmon and steelhead with coded wire tags (based on fin clips) by cutting through the head from behind the orbit down to the mouth. Snouts are placed in plastic bags and given an individual snout number for identification. Snouts and accompanying biological data are sent to ODFW's, Mark Process Center in Clackamas for coded wire tag extraction and reading. Kidney samples are collected on the spawning ground from spring chinook with coded wire tags that have been dead for less than 48 hours. Samples are frozen and taken to the ODFW pathology laboratory in La Grande for analysis.

Objective 2. Estimate timing and survival of juvenile salmon and steelhead migrating from the headwaters of the Umatilla River to the lower Columbia. This is a motoring objective with the underlying hypothesis that natural smolt survival will increase over time as a direct result of adaptive management and rehabilitation efforts. Furthermore, survival estimates from the headwaters to TMD and the lower Columbia will indicate how successful smolts negotiate these reaches.

Task 2.1 Pit tag natural juvenile chinook and summer steelhead collected in the headwaters of the Umatilla River Basin with rotary screw traps, electrofishing and other methods.
Task 2.2 Develop and submit tagging, mortality and release files to PTAGIS.
Task 2.3 Extract and examine PIT tag detection files from PTAGIS.
Task 2.4 Estimate timing and minimum survival from PIT tag detections at all down-river interrogation sites.
Task 2.5 Estimate smolt to adult survival from adult detections at lower Columbia River dams and at TMD in future years.
Task 2.6 Report findings and discuss management implications

Objective 2. Methods

We operate two rotary screw traps five feet in diameter, (E.G. Solutions, Inc. design) to capture emigrating juvenile salmonids. One trap is installed near the USGS gagging near Gibbon in the Umatilla River (RM 81.7). The trap operates from September to June with starting dates depending on flows. The second trap is installed in Meacham Creek (RM 1.5) and is operated from October through May. Low flows prevent trapping through the summer months.

We record the following data daily: trap site, date, time, number and species of fish captured, lengths, marks, clips, number of fish marked and released and comments regarding weather, stream flows and trap effectiveness. Non-salmonid species are counted or estimated when large numbers are captured.

Trapping catch efficiency is estimated by marking salmonids with temporary clips of the outside ¼ of a fin. Marked salmonids are released approximately 100 to 1,000 m above the rotary traps during the day depending on flows. Recaptured salmonids are counted, measured and released below the trap. Additional marked juvenile salmonids are placed in the livewell for 24 hours to determine containment rates. Minimizing escapement from the livewell through containment monitoring (and repair when necessary) increases effective catch rates. Depending on availability, we use one to 100 fish of a given species and size class for mark-recapture and containment trials.

Trap efficiency estimates and total migrants at the Imeques trap site are calculated by averaging weighted, multiple, running means from catch, mark and recapture trials of three to 13 days. Total fish migrating past the trapping site during the multiple running time periods of 3 to 13 days are calculated by dividing total catch by the mean catch rate for the time period. No estimates are made when the traps are not operating due to floods, ice, heavy debris or repair.

Assumptions used to estimate trap catch rates and the number of salmonids migrating past the traps include: 1) marked and unmarked salmonids are actively migrating past the trap; 2) fish downstream of the trap did not return to risk capture again; 3) previously captured, handled and marked fish released upstream of the trap have an equal probability of capture as un-handled fish; 4) recaptured fish escape from the livewell at the same rate as un-handled fish; 5) marks on recaptured fish are correctly recognized and recorded by samplers, and 6) no mortality of marked fish occurs between the release site and the trap.

We will PIT tag age 1+ chinook and steelhead with smolt or partial smolt characteristics. After fish are anesthetized with MS222 (tricaine methane-sulfonate), trained personnel PIT tag them by hand with sterile syringes. PIT tagged fish will be measured, held for observation and released. We will submit the appropriate tagging and release files to PTAGIS according to the procedures detailed in the most recent PIT Tag Specification Document (Stein, 1998). ODFW will also PIT tag natural smolts at TMD and we will examine differential survival to the John Day Dam based on tagging and release locations. Originally, we planed to estimated total smolt emigration by examining the ratio of tagged to untagged natural smolts at TMD collected by ODFW. However, ODFW will no longer examine natural smolts by hand and will not be able to estimate the ratio of tagged to untagged natural smolts. Therefore we will estimate minimum smolt survival from tagging to detection at TMD and at John Day, The Dalles and Bonneville Dam based on PIT tag detection and overall detection rates at each dam. We will also estimate total smolt to adult survival of natural juvenile chinook and steelhead with the following formula:

$$\left[\frac{\dfrac{T}{R-1}}{C}\right](TRR)$$

Where	T =	Number of PIT tagged individuals released
	R =	Number of unique PIT tagged adults (Umatilla origin) observed returning at either the Columbia River dams and at TMD. .
	C =	Total number of tagged and untagged natural adults observed at TMD
	TRR =	Mean tag retention rate.

We assume that tagged fish have the same mortality and residualization rate as untagged fish. We assume that 99% of all tags will be retained and function at the lower river detection sites even though only a small proportion may be detected. We assume 1+ chinook and steelhead with smolt characteristics migrate to the ocean during the same outmigration season.

Objective 3. Estimate juvenile salmonid abundance and rearing densities in index sites and selected stream reaches in the Umatilla River Basin. This is a monitoring program with an underlying hypothesis that distribution and rearing densities of natural juvenile salmon and steelhead will increase through rehabilitation efforts.

Task 3.1 Electrofish established index sites. Isolate the site with block-nets and use depletion methods to estimate salmonid densities.

Task 3.2 Electrofish selected stream reaches using block-nets and depletion methods to estimate salmonid densities and abundance in priority areas as defined by the Management Oversight Committee.

Task 3.3 Digitize and summarize capture data, estimate densities and abundance, examine trends, report findings and discuss management implications.

Objective 3. Methods

We use backpack electroshockers to sample juvenile salmonids. Block-nets are used to contain the fish within a measured area. Salmonids are captured with dip nets and removed on successive electrofishing passes until a depletion rate of at least at 60% is achieved. The same individual samples in a similar manner for the same number of seconds (or slightly more) as the previous pass. Electroshocker settings (i.e. volts, pulse) remained constant for each removal pass. Additional passes are not conducted if salmonids are neither captured nor observed during the first pass.

Captured salmonids are placed in a livewell until the completion of all passes. Fish are identified to species, measured (fork length, mm) and inspected for fin clips, brands or marks. We record injuries, signs of disease or stress. Juvenile spring chinook salmon are not differentiated from juvenile fall chinook salmon. Anadromous rainbow are not differentiated from resident rainbow.

Crews collect scale samples from a wide variety of fish sizes for age and growth determination. We remove approximately 6-12 scales from an area two scale rows above the lateral line, posterior to the dorsal fin, and anterior to the adipose fin. Scales are mounted in the field directly onto clear mylar envelopes. Stream name, site, date, species and fork length are recorded on the mylar. No additional handling or mounting is required before reading.

Estimates of salmonid abundance are calculated with a maximum-likelihood model (Van Deventer and Platts 1989) from the number of salmonids captured during successive electrofishing removal passes. Densities are estimated by dividing estimated salmonid abundance by measured wetted channel area.

We sample established index sites located throughout the Umatilla River Basin to monitor salmonid densities, species composition and relative abundance through time. Index sites are a minimum of 100 m in length and may be more that 300 m. The lower and upper boundary of each site is marked with numbered tags to assist consistent sampling. Most tags were placed on living trees or on wooden posts outside of the active channel to avoid tag loss during high flows. Crews measure, photograph and describe sampling sites. Each index site is marked on a Umatilla River Basin map.

We sample index sites during August and early September when flows and conditions are the most consistent from year to year. Crews sample additional sites to evaluate distribution and seasonal habitat utilization. Crews also conduct intensive salmonid density surveys with similar methods but sample up to 15 % of the entire stream. Stratified sample designs are used to select multiple sampling sites for intensive reach surveys.

Objective 4. Estimate tribal harvest of adult salmon and steelhead returning to the Umatilla River Basin (assist BIA personnel). This is a monitoring objective with an underlying hypothesis that tribal harvest for all anadromous species will increase through rehabilitation efforts. Harvest estimates are also required to determine the number of adults available for natural spawning.

Task 4.1 Design and implement roving creel surveys and telephone surveys depending on the seasons and locations of the fisheries as determined by Tribal Authorities.

Task 4.2 Digitize and summarize data, estimate harvest, and report findings.

Objective 4. Methods

The variability from year to year of the tribal angling seasons and locations often requires significant modifications of earlier survey designs. We employ non-uniform probability roving creel surveys designed after Malvestuto (1983 and Malvestuto et al. 1978). However, angling effort can be so light that the typical creel surveys generally do not yield sufficient data to calculate effort, catch rates and harvest. The most consistent index for tribal harvest has been telephone surveys of tribal anglers. The unique nature of the local community allows a more comprehensive index of harvest by telephone and off river interviews than more traditional sport fisheries.

Objective 5. Monitor stream temperatures in the Umatilla River Basin in cooperation with other monitoring agencies. This is a monitoring objective with an underlying hypothesis that watershed rehabilitation efforts will improve water temperature profiles over time.

Task 5.1 Meet with other agencies to coordinate temperature monitoring activities.

Task 5.2. Deploy 6 Ryan RTM2000 and 15 Vemco Minilog thermographs during April of 2000. Check status and function of thermographs in July.

Task 5.3 Retrieve thermographs in November. Download, summarize and graph data. Examine trends, report findings and discuss management implications.

Objective 5. Methods

CTUIR, ODFW, U.S. Forest Service (USFS) and U.S. Bureau of Reclamation (BOR) coordinate the deployment of 53 thermographs and 4 HYDROMET stations in the Umatilla River Basin to maximize consistency and coverage without duplicating effort. We initialize, download and deploy the thermographs in the office or field with a portable computer. We install new batteries in the RYAN RTM 2000s as well as clean and inspect the seals and clamps. Steel chains or cables anchor the units to large trees or boulders on the shore. Thermographs and cables are concealed to minimize tampering. Crews take photographs and write detailed descriptions of each thermograph location. We also draw vicinity maps and mark 7.5 minute topographic maps. Temperature data will be examined in relation to past data, water quality standards, and critical levels published in the literature (Black 1953, Brett 1952).

Objective 6. Determine age, growth and life history characteristics of bull trout, salmon and steelhead in the Umatilla River Basin. We hypothesize that through a better understanding of age, growth and life history characteristics of Umatilla Basin salmonids, best management alternatives can be developed and employed to maintain and enhance salmonids.

Task 6.1 Take scale samples from juvenile and adult bull trout, salmon and steelhead during trapping, electrofishing, artificial spawning and natural spawning surveys.

Task 6.2 Mount and press adult scale samples. Place juvenile scales directly between labeled acetate sheets at the time of sampling.

Task 6.3 Determine the proportion of unmarked adult salmon that are of hatchery and natural origin based on circuli counts from the scale focus to the first annuli.

Task 6.4 Determine the years of freshwater and saltwater rearing of naturally produced adult salmon and steelhead.

Task 6.5 Digitize and summarize data, report findings and discuss management implications.

Objective 6. Methods

We take five scales from the preferred area (two scale rows above the lateral line on the left side of the fish in a diagonal line between the posterior edge of the dorsal fin and the anterior edge of the anal fin). Because of the high incidence of regenerated scales on adults, we also take scales from the other side of the fish two rows below the lateral line in the preferred area). We mount adult scales on gum cards and press them into cellulose acetate. Length, sex and species are kept with each scale sample. We collect approximately ten scales from each juvenile salmonid sampled in the preferred area. Scales are spread out between folded strips of labeled mylar. Adult and juvenile scales are analyzed under a microfiche reader at magnifications of 42x and/or 72x.

We age scales with the European Method of age designation: (i.e. age 1.2 denotes a fish that migrated from freshwater during its second year of life and spent two winters rearing in the ocean). One or two readers examine all scales. Both readers examine scales with questionable ages. Differences in age interpretation are discussed. If a clear interpretation can not be determined, the scale is eliminated from the sample.

Life history characteristics of natural salmonids in the Umatilla Basin will be compiled from findings obtained from trapping, electrofishing, reading scales and examining natural adult return data provided by this and other projects (Contor et al. 1997, Zimmerman and Duke 1995, Rowan 1991, Knapp et al. 1996 and 1997).

Objective 7. Determine and compare genetic characteristics (DNA and electrophoresis) of Umatilla River steelhead with previous genetic data. We hypothesis that the current artificial propagation project will not change genetic characteristics of Umatilla River natural steelhead overtime.

Task 7.1 Deliver genetic samples collected in FY1999 to one or several laboratories for analysis. CRITFC geneticists will analyze the data, report findings, and discuss management implications (FY2000).

Task 7.2 Attach the geneticist report to the annual report (FY2000).

Objective 7. Methods

Because genetic analysis is technical in nature, we will develop a contract with a geneticist and laboratory to assist us in the sample design and sample collection protocol. Methods will likely follow Nei (1974), and Currens and Schreck (1995). During 1999 samples will be collected in the field by trapping and electrofishing and super frozen with liquid nitrogen and shipped to CRITFC's super cold freezer. During FY2000, CRITFC will ship samples to the laboratory for processing. The laboratory results will be forwarded to a geneticist for analysis and report preparation.

Objective 8. Improve and update the monitoring and evaluation strategies for the Umatilla River Basin. Coordinate with the Management Oversight Committee to ensure an effective and adaptive monitoring and evaluation program. This objective is based on the underlying assumption that the best adaptive monitoring program is maintained when research and management regularly explore, evaluate and prioritize monitoring needs.

Task 8.1 Meet with administrators, managers and researchers to determine monitoring and evaluation needs.

Task 8.2 Modify and develop the monitoring and evaluation project to meet continuing and developing information needs.

Objective 8. Methods

The methods are sufficiently defined in the tasks above

Objective 9. Examine the movements of 30 adult fall chinook salmon after transport to the Umatilla River from Priest Rapids Hatchery and or Ringold Springs Hatchery. The hypothesis is that adult fall chinook transported to the Umatilla River in early to mid October will not leave but will remain in the Umatilla River and spawn naturally.

Task 9.1 Radio-tag and release 30 adult fall chinook into the Umatilla River in early to mid October.

Task 9.2 Monitor the movement of radio tagged adult fall chinook with fixed site and mobile receivers.

Task 9.3 Summarize results, report findings and discuss management implications.

g. Facilities and equipment

Office Space and Equipment includes: four offices work areas; six desks, chairs and file cabinets; five bookshelves; five Pentium II computers with current hardware, software and printers; two locking storage cabinets, and two locking indoor storage areas with shelves.

GSA Vehicles and Fenced Lot includes five GSA 4X4 vehicles, three with winches, and all with two way radios (Suburban, Ford Bronco, Ford pickup, and two Dodge pickups). The project also has one 5x10,' 5000 pound capacity, flatbed trailer. A fenced lot with locking gates is available for vehicle storage.

Field Equipment includes two rafts, three Model 12 Smith-Root backpack electroshockers with batteries and chargers, two, five-foot in diameter, E.G. Solution rotary screw traps, four large winches for trap adjustment. Additional equipment includes one four wheeler, two trail bikes, two wet suits, two dry suits, associated gear, two dive lights, two ATV trailers, three box traps, a 4000 Watt generator and power tools.

Cameras and Instruments include six Ryan RTM2000 thermographs, 15 Vemco Minilogger thermographs (we will purchase 10 more in 1999), four Suunto clinometers, four Suunto mirror compasses, four mass scales and two range finders. Radio telemetry equipment includes five LOTEK SRX 400 telemetry receivers, associated dry boxes, cable and antennas. Camera equipment includes one digital camera, three film cameras, two Panasonic time lapse VCR recorders, and two Panasonic video cameras with lenses, tripod and power supplies (for passage monitoring). The project also has an EyeCom 3000, full size COM reader (for scale analysis) and a Micronta electronic multi-tester;

Contracted Expertise and Laboratory Services: Contracting with established genetic researchers and laboratories will provide the needed expertise and equipment for quality genetic evaluations.

h. Budget

Personnel costs are based on the equivalent of 6.25 full time employees. However, a number of the employees only work part time on this project. We could reduce cost further only by eliminating more tasks and/or objectives. This program has reduced its personnel needs from 10 to 6.5 during the last three years. Through training and streamlining we maintained 80% of our productivity with 60% of our personnel. Wages are set and follow similar range and step schedule as federal employees. Increases in personnel costs occur each year through the cost of living adjustments (COLA). COLA rates are based on inflation. Wage step-increases will stop within several years, as most employees will reach their maximum step. Our estimates for out-year costs reflect the COLA and step changes. Fringe benefits and indirect costs (29% and 34% respectively) are set by CTUIR administration and can not be changed at the program or project level. Costs for services and supplies are lower than previous years and include PIT tags, repair, office supplies, communications charges, and field equipment. The travel budget is primarily for GSA vehicles (rental, mileage and insurance). Travel also includes per diem for personnel to attend training meetings and give presentations. A subcontract with CRITFC is scheduled for FY2000 to process genetic samples, summarize data and write reports. This subcontract is for one year and is necessary for successful genetic monitoring, as we do not have the required equipment or personnel.

Section 9. Key personnel

Gary James
Fisheries Program Manager

Education

Graduated 1979, Oregon State University
Bachelor of Science Degree in Fisheries

Employment

1982 – Present, Fisheries Program Manager (0.08 FTE) Confederated Tribes of the Umatilla Indian Reservation. Duties: manage Tribal Fisheries Program; supervise project leaders and coordinate salmonid restoration and enhancement efforts among various agencies and projects for the Umatilla, Walla Walla, John Day, Grande Ronde and Imnaha River Basins.

Craig R. Contor
Project Leader

Education
1986-1988. Idaho State University, Pocatello, Idaho. Graduated with a Master of Science degree in Biology (Fish Ecology) in May of 1989

1983-1986. University of Idaho, Moscow, Idaho. Graduated with a Bachelor of Science degree in Fishery Resource Management,

1981-1983. Peninsula College, Port Angeles, Washington. Transferred to the University of Idaho with credits in general science, math, and writing.

Fisheries Related Employment
1993-1998, Project Leader, Umatilla and Walla Walla Basins Natural Production Monitoring and Evaluation Projects (0.84 FTE). Confederated Tribes of the Umatilla Indian Reservation, Pendleton Oregon. The project leader coordinates and supervises activities that include salmon and steelhead spawning surveys, habitat surveys, age and growth determinations, and estimating salmonid survival, abundance and distributions. Additional tasks include coordinating efforts with ODFW, USFS and WDFW, analyzing data, writing reports, hiring personnel, training and evaluating personnel, developing and tracking budgets and expenditures, and developing work plans, proposals, sample designs and sampling protocols. .

1992-1993, Fisheries Researcher, Idaho Department of Fish and Game, Eagle, Idaho.

1990-1991 Fisheries Project Biologist, Idaho Power, Department of Environmental Affairs, Boise, Idaho.

1988-1990 Fisheries Technician (NTE), U. S. Forest Service, Intermountain Research Station, Boise, Idaho.

1986-1988, Idaho State University, Research Assistant and Volunteer Teaching Assistant.

1984-1985, Bio-Aid, Idaho Cooperative Fish and Wildlife Research Unit, Moscow, Idaho.

Certificates of Training
Regular CPR and First Aid Training 1988-1998
Open Water SCUBA Diving Certificate, 1991
Open Water SCUBA Rescue Diver Training, 1991
IFIM training, 1991, IFIM 200, 201 and 310.

Awards
1989, Certificate of Merit, Awarded for Superior Performance in the Evaluation of the COWFISH Model, USFS, Intermountain Research Station.

1989, Special Award for Outstanding Research and Conservation Efforts, from the Henry's Fork Foundation.

1985, Outstanding Senior, Fishery Resources, College of Forestry, Wildlife and Range Sciences, University of Idaho, Moscow, Idaho 83843.

Recent Project Reports
Senior author of six Umatilla Basin Natural Production Monitoring and Evaluation Project Annual Reports, 1992-93 through 1998.

Paul Kissner
Senior Biologist

Education
Graduated 1968, Colorado State University
Bachelors of Science Degree in Fisheries Biology

Employment

10/1992 – Present. Senior Fisheries Biologist (1.0 FTE). Confederated Tribes of the Umatilla Indian Reservation. Duties: responsible for monitoring escapement and spawning of adult salmonids above Three Mile Falls Dam in the Umatilla River; supervise 1-5 fisheries technicians; monitor spawning success; estimate egg deposition, collect biological data on spring and fall chinook and coho salmon and summer steelhead; read scales; digitize and summarize data, and write annual reports.

1988-1990. Temporary Fishery Research Biologist. Alaska Department of Fish and Game. Duties: trained various fishery biologists in aerial survey techniques to enumerate the chinook escapement in southeast Alaska; conducted field studies, and wrote completion reports.

1971-1987. Chinook Salmon Research Project Leader. Alaska Department of Fish and Game. The major objective was to determine the status of southeast Alaska wild chinook salmon stocks. This was accomplished by development of methods to determine the origin of chinook salmon harvested in mixed stock ocean fisheries (scale pattern analysis and coded wire tagging) and enumeration of spawners in major basins. Duties: developed project objectives, managed an annual budget of $150,000 -$300,000; analyzed data collected, prepared annual reports, hired and evaluated 1-10 seasonal employees and an assistant project leader; explained data findings and presented results at various user group meetings and at the Board of Fisheries annual meeting; Member of the Chinook Salmon Technical Committee that dealt with a broad gamut of chinook salmon issues in southeast Alaska, and a member of the Transboundary River Treaty associated with the U.S. Canada Salmon Treaty. Retired from the Alaska Department of Fish and Game on September 30, 1987.

1969-1971. Assistant Project Leader. Alaska Department of Fish and Game.
Cook Inlet Sockeye Salmon Research Project. Duties: enumerate adult sockeye in Cook Inlet and conduct studies to separate mixed stocks; supervised up to 10 fishery technicians, and assisted in data analysis, preparing reports and developing annual budgets.

1967-1969. Crew Leader. Alaska Department of Fish and Game.
Duties: supervise crew on dolly varden charr life history project.

Additional Training
Sea Survival 1984
Law Enforcement 1979
Measuring Job Performance 1978
Basic Law Enforcement Training 1977

Publications
Co-author of five Umatilla Basin Natural Production Monitoring and Evaluation Project reports 1992-93 through 1996-97 (see references listed in section 7.g. of this document).

Mecum, R. D. and P. D. Kissner, Jr. 1989. A study of chinook salmon in southeast Alaska. Alaska Department of Fish and Game, Division of Sport Fish, Data Series 117, Juneau Alaska.

Kissner, Paul D. 1985. A study of chinook salmon in southeast Alaska. Alaska Department of Fish and Game. Annual Report 1984-1985. Project f-9-17, 26 (AFS-41).

Section 10. Information/technology transfer

We provide information through monthly Oversight Committee meetings, annual operation planning meetings, quarterly reports, annual reports, and formal presentations. We provide raw data and summarized data on diskettes to managers and researchers upon request. Our information assists managers and researches in adaptively managing local steelhead and salmon stocks. Our findings could also apply to salmonid restoration efforts throughout the Columbia River Basin.

Congratulations!